PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
LAURA A. CORUZZI
JONES DAY
222 EAST 41ST STREET
NEW YORK, NY 10017-6702

PCT 13 JUN 2005
WIPO PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Applicant's or agent's file reference 10589-33-228	Date of mailing (*day/month/year*) 09 JUN 2005 **FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US04/09574	26 March 2004 (26.03.2004)	27 March 2003 (27.03.2003)

International Patent Classification (IPC) or both national classification and IPC

IPC(7): A01N 61/00; C12Q 1/00; G01N 33/566, 573 AND 574 and US Cl.: 435/4, 6, 7.2, 7.21, 41, 69.2, 91.3, 183; 514/1, 2

Applicant

PTC THERAPEUTICS, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☐ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(*b*) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Valerie Bell-Harris for Mark L. Shibuya Telephone No. (571) 272-1600

Form PCT/ISA/237 (cover sheet) (January 2004)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/09574

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material

      ☐ a sequence listing

      ☐ table(s) related to the sequence listing

   b. format of material

      ☐ in written format

      ☐ in computer readable form

   c. time of filing/furnishing

      ☐ contained in international application as filed.

      ☐ filed together with the international application in computer readable form.

      ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/09574

Box No. IV Lack of unity of invention

1. ☐ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has:
   - ☐ paid additional fees
   - ☐ paid additional fees under protest
   - ☐ not paid additional fees
2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
   - ☐ complied with
   - ☐ not complied with for the following reasons:

4. Consequently, this opinion has been established in respect of the following parts of the international application:
   - ☒ all parts.
   - ☐ the parts relating to claims Nos. _____

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/09574

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-28, 33-39	YES
	Claims 29-32, 40, 41	NO
Inventive step (IS)	Claims NONE	YES
	Claims 1-41	NO
Industrial applicability (IA)	Claims 1-41	YES
	Claims NONE	NO

2. Citations and explanations:

Please See Continuation Sheet

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/09574

Supplemental Box
In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

Claims 29-32, 40 and 41 lack novelty under PCT Article 33(2) as being anticipated by US 5,726,195 A (HILL et al.).
Hill et al. discloses small molecule antifungal (e.g. anti-yeast) compounds for treating microbial infections when administered to a host, (e.g., human). These compounds inhibit tRNA enzymes (e.g. synthetases) and comprise structure within the scope of the presently claimed invention (e.g. see examples and patent claims). The ability to inhibit tRNA splicing endonuclease is inherently present due to the ability of these compounds to bind tRNA. In any event, the claim is not structure-limited and the PTO lacks the facilities for making comparisons between prior art compounds and the claimed prospective assay-derived compounds.

Claims 29-32, 40 and 41 lack novelty under PCT Article 33(2) as being anticipated by WO 01/25486 A1 (RANA).
Rana discloses assay-derived tRNA inhibiting (e.g., binding: see e.g. bottom of page 9-top of page 10; and claims, especially claims 1, 2, 28-30, 40-43) compounds within the scope of the presently claimed invention (e.g., claims 25-26) that are antifungal for use in treating fungal (e.g. yeast: see claims 47-48) infections (e.g., see page 10-11) when administered to humans. The ability to inhibit tRNA splicing endonuclease is inherently present due to the ability of these compounds to bind RNA (e.g. tRNA). In any event, the claim is not structure-limited and the PTO lacks the facilities for making comparisons between prior art compounds and the claimed prospective assay-derived compounds.

Claims 29-32, 40 and 41 lack novelty under PCT Article 33(2) as being anticipated by WO 02/083837 A1 (ALMSTEAD).
Almstead discloses assay-derived binding compounds (e.g. see pages 3-4; bottom of page 10-11) within the scope of the presently claimed invention (e.g. see pages 21-23; claim 5) that are antifungal for use in treating fungal (e.g., yeast) infections when administered to humans. The ability to inhibit tRNA splicing endonuclease is inherently present due to the ability of these compounds to bind RNA (e.g. tRNA). In any event, the claim is not structure-limited and the PTO lacks the facilities for making comparisons between prior art compounds and the claimed prospective assay-derived compounds.

Claims 29-32, 40 and 41 lack novelty under PCT Article 33(2) as being anticipated by WO 02/083953 A1 (RANDO et al.).
Rando et al. disclose assay-derived RNA binding (e.g., tRNA) compounds which effect RNA host cell factor complexes in vivo (e.g. RNA splicing: see page 10; bottom of page 12-page 13) which compounds are within the scope of the presently claimed invention (e.g. see claim 5) that are antifungal for use in treating fungal (e.g., yeast) infections when administered to humans. The ability to inhibit tRNA splicing endonuclease is inherently present due to the ability of these compounds to bind RNA (e.g. tRNA). In any event, the claim is not structure-limited and the PTO lacks the facilities for making comparisons between prior art compounds and the claimed prospective assay-derived compounds.

Claims 1-34, 36-51, 53 and 54 lack an inventive step under PCT Article 33(3) as being obvious over WO 01/25486 A1 (RANA), WO 02/083837 A1 (ALMSTEAD), and/or WO 02/083953 A1 (RANDO et al.) in view of WANG et al., Nucleic Acids Research Vol. 18, No. 22, HYDE-DERUYSCHER et al., Chem. & Biol. Vol. 7, No. 1, and LI et al., Science Vol. 280 (4/1999).
The presently claimed invention is directed to identifying antifungal compounds by screening (e.g., high throughput assays) compounds (e.g., library derived) for their ability to inhibit the endonucleolysis of fungal tRNA by inhibiting tRNA-tRNA splicing endonuclease binding, relative to a control.

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/09574

Supplemental Box
In case **the space in any of the preceding boxes is not sufficient.**

Screening assays (e.g., high throughput assays) of single compounds or compound libraries for their ability to disrupt RNA (e.g., tRNA) interactions (e.g. including splicing) in order to identify antifungal drug candidates is taught by the RANA, ALMSTEAD and/or RANDO reference whose teaching discussed above is hereby incorporated by reference in its entirety.

The RANA, ALMSTEAD and/or RANDO reference methods differ from the presently claimed invention by failing to explicitly teach the application of its methods to tRNA splicing endonuclease assays that cleave tRNA and tRNA splicing endonuclease.

However, LI et al. teach that the tRNA splicing pathway is analogous in mammals and other organisms (e.g., fungi).

In this regard, WANG et al. teach an assay for endonucleolytic tRNA maturation, where inactivated micrococcal nuclease (reversible inhibitor) bound to radiolabeled pre-tRNA physically blocks the sites of endonuclease cleavage and prevents tRNA processing activities present in Fraction III of spinach chloroplasts, presumably by substrate occlusion or "masking", where formation of an inactive micrococcal nuclease enzyme substrate complex precludes utilization of the tRNA substrate by a second enzyme.

Additionally, the HYDE-DERUYSCHER et al. reference teaches that high throughput screening of "small molecule" compound libraries (e.g., phage) is ideal for screening "small molecule" enzyme inhibitors for a variety of different enzymes.

Accordingly, it would have been obvious to use tRNA splicing endonuclease assays in the high throughput screening methods of RANA, ALMSTEAD and/or RANDO, because these references specifically suggest screening small molecules libraries for compounds which disrupt tRNA interactions, including splicing, and in light of the secondary reference teaching that tRNA splicing pathway in fungi is known and analogous; and the known teaching of tRNA splicing endonuclease inhibition; with the desirability of using high throughput screening of small molecular libraries for screening enzyme binding compounds as drug candidates.